

COVID-19: in the footsteps of Ernest Shackleton

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ABSTRACT

We describe what we believe is the first instance of complete COVID-19 testing of all passengers and crew on an isolated cruise ship during the current COVID-19 pandemic. Of the 217 passengers and crew on board, 128 tested positive for COVID-19 on reverse transcription-PCR (59%). Of the COVID-19-positive patients, 19% (24) were symptomatic; 6.2% (8) required medical evacuation; 3.1% (4) were intubated and ventilated; and the mortality was 0.8% (1). The majority of COVID-19-positive patients were asymptomatic (81%, 104 patients). We conclude that the prevalence of COVID-19 on affected cruise ships is likely to be significantly underestimated, and strategies are needed to assess and monitor all passengers to prevent community transmission after disembarkation.

We describe what we believe is the first instance of complete COVID-19 testing of all passengers and crew on an isolated cruise ship during the current COVID-19 pandemic. The expedition cruise ship departed from Ushuaia, Argentina, for a planned 21-day cruise of the Antarctic Peninsula, including Elephant Island, before sailing to South Georgia Island on a route similar to that taken by the British explorer, Ernest Shackleton, in 1915–1917. The ship departed mid-March 2020, after the global COVID-19 pandemic was declared by the WHO, with all 128 passengers and 95 crew screened for COVID-19 symptoms, and body temperatures were taken before boarding. No passengers or crew that had transited through China, Macau, Hong Kong, Taiwan, Japan, South Korea or Iran in the previous 3 weeks were permitted to board, given that these countries were where COVID-19 infection was most prevalent at the time. Multiple hand hygiene stations were positioned throughout the ship and especially in the dining area.

AI and CC were passengers, and JG was the expedition physician. The ship departed as scheduled and, for the next 7 days, crossed the Drake Passage and explored the Antarctic Peninsula visiting locations, including Danco Island, Paradise Bay, Lemair's Passage and Deception Island. All passengers and crew were well during this period, and all passengers and crew had regular body temperature reviews performed by the ship's two physicians. On day 3, a decision was made to terminate the cruise due to newly announced international border controls and travel restrictions instigated in response to the COVID-19 pandemic. The plan was to complete the Antarctic portion of the cruise and to return back to Ushuaia for arranged charter flights on day 14 and thus abandoning the South Georgia component of the cruise.

The first recorded fever on board the ship was a febrile passenger on day 8. Isolation protocols

were immediately commenced, with all passengers confined to cabins and surgical masks issued to all. Full personal protective equipment was used for any contact with any febrile patients, and N95 masks were worn for any contact with passengers in their cabins. The crew still performed duties, including meal services to the cabin doors three times a day, but rooms were not serviced. Expedition staff helped with crew duties at meal service.

Further fevers were detected in three crew on day 10, two passengers and one crew on day 11, and three passengers on day 12.

As Argentina had closed its borders, and permission to disembark at Stanley, Falkland Islands, was refused, the ship sailed to Montevideo, Uruguay, arriving the evening of day 13 ([figure 1](#)). The majority of febrile patients had improved with symptomatic treatment and were afebrile on arriving at Montevideo.

Rapid testing kits for COVID-19 (VivaDiag qSARS-CoV-2 IgM/IgG) were delivered on board and performed on six passengers and crew, who had initial fevers. All returned negative results on day 14. Permission to dock was refused by Uruguayan officials until formal nasal swab testing for COVID-19 real-time reverse transcription PCR (RT-PCR) testing was performed on all on board.

Three additional passengers and crew developed fever on day 14, but with mild cough and lethargy only. One of these passengers, a 68-year-old man who was a lifelong non-smoker with no comorbidities, deteriorated and required urgent medical evacuation to a hospital in Montevideo on day 17. He was intubated and ventilated and tested positive for COVID-19 (RT-PCR).

A total of eight passengers and crew were medically evacuated from the ship to hospitals in Montevideo, all for impending respiratory failure, including a 70-year-old woman with chronic obstructive pulmonary disease (evacuated day 20), a 65-year-old woman with no comorbidities (evacuated day 21), and two crew and one passenger evacuated on day 22. A seventh passenger, a 68-year-old man, developed fever on day 23 (15 days after cabin isolation) and was evacuated for hypoxaemia on day 24. One of the two ship physicians required medical evacuation on day 27 also for hypoxaemia. All evacuated patients subsequently tested positive on 2019-nCoV RT-PCR.

The Uruguayan Ministry of Health provided on board SARS-CoV-2 virus testing of all passengers and crew, which occurred on 3 April (day 20; ATGen-Diagnostica, Montevideo) with CDC 2019-nCoV Real-Time RT-PCR Diagnostic Panel.

Of the 217 passengers and crew on board, 128 tested positive for COVID-19 (59%). These included all passengers who tested negative on the VivaDiag qSARS-CoV-IgM/IgG Rapid Test. There



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Figure 1 Original and subsequent route of cruise ship.

were 10 instances where two passengers sharing a cabin recorded positive and negative results.

Despite 128 (59%) of the population testing positive, fever and mild symptoms were present in only 16 of 128 COVID-19-positive patients (12.5%), with another 8 medically evacuated (6.2%) and 4 requiring intubation and ventilation (3.1%). There has unfortunately been one death to date (0.8%). There were therefore a total of 24 COVID-19-positive patients who were symptomatic (19%), with the majority being asymptomatic (104 patients or 81%).

From the departure date in mid-March 2020 and for the next 28 days, the expedition cruise ship had no outside human contact and was thus a totally isolated environment in this sense.

With gratitude to the Uruguayan Government and Ministry of Health, they were able to provide a sanitary corridor for the repatriation of 112 Australian and New Zealand passengers on day 28 and for all other passengers on day 32. These included

both COVID-19-positive and COVID-19-negative passengers.

We conclude from this observational study that

1. The prevalence of COVID-19 on affected cruise ships is likely to be significantly underestimated, and strategies are needed to assess and monitor all passengers to prevent community transmission after disembarkation.¹
2. Rapid Ab COVID-19 testing of patients in the acute phase is unreliable.²
3. The majority of COVID-19-positive patients were asymptomatic (81%).
4. The presence of discordant COVID-19 results in numerous cabins suggests that there may be a significant false-negative rate with RT-PCR testing. Follow-up testing is being performed to determine this.
5. The timing of symptoms in some passengers (day 24) suggests that there may have been cross contamination after cabin isolation.

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Addendum Following online publication of the paper, a query was raised regarding the difference between the number of tests conducted (217) and the number of passengers and crew believed to be on board ship at the time (221). The authors wish to clarify that testing took place on Day 20. All passengers and crew received written confirmation of their tests by Day 24. The data from ATGen-Diagnostica and testing on the 2 evacuated passengers by Day 20 records a total of 217 individual test results. The authors feel this is an accurate portrayal of the denominator as the testing methodology was strict and are confident everyone on board at the time was tested.

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